

RESEARCH ARTICLE

The Effect of Contrast Hydrotherapy on The Degree of Phlebitis in Children

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ABSTRACT

Phlebitis in children receiving maintenance intravenous therapy at home is a significant health concern, as it may lead to serious complications if not managed appropriately. One potential intervention to address this issue is contrast hydro therapy. The aims of this study were to examine the effect of contrast hydro therapy on the severity of phlebitis in children. This study employed pre-experimental design with a one-group pretest-posttest approach. The sample consisted of 20 children diagnosed with phlebitis, selected through purposive sampling. Inclusion criteria were children aged 6–18 years experiencing phlebitis due to intravenous therapy, with a Visual Infusion Phlebitis (VIP) score of 2 or 3. The intervention involved the application of contrast hydro therapy using alternating warm and cold compresses to the affected area. The degree of phlebitis was measured using the VIP score before and after the intervention. Data were analyzed using non-parametric statistical analysis with the Wilcoxon signed-rank test. The mean phlebitis score before the intervention was 2.55, which decreased to 0.2 after the contrast hydro therapy. Statistical analysis showed a significant difference, with a p-value < 0.000. There was a significant reduction in the severity of phlebitis following contrast hydro therapy in pediatric patients.

1. Introduction

Every medical procedure carries a risk of side effects, including the insertion of a venous catheter. In addition to causing pain, this procedure also poses a risk of phlebitis. Phlebitis is defined as inflammation of the veins, characterized by pain, redness, swelling, warmth, and hardening around the puncture site and along the affected vein (Maragani et al., 2021). Data from the Indonesian Ministry of Health (2017) reported that the prevalence of phlebitis in government hospitals reached 50.11%, while in private hospitals the figure was 32.70% (Rahmawati et al., 2020). In Indonesia, the prevalence of phlebitis in children varies. For instance, a study conducted at Dr. Moewardi Hospital in Surakarta revealed a prevalence of 0.98% among 3,037 hospitalized pediatric patients (Bunga & Widhiati, 2018). Furthermore, more than 50% of children undergoing infusion therapy for up to 96 hours are reported to experience either phlebitis or infiltration (Annisa et al., 2017). Data collected over three months, May–July 2024, from the pediatric care unit of a regional public hospital in West Jakarta indicated a phlebitis incidence rate of 14.86 per mille, which exceeds the hospital's standard threshold of 10 per mille.

Phlebitis can be identified by various clinical signs of inflammation caused by peripheral venous catheter insertion. These signs include pain at the catheter site, redness, swelling, warmth, and induration along the vein (Guanche-Sicilia et al., 2021). The risk factors contributing to phlebitis are categorized into internal and external factors. Internal factors include age, gender, nutritional status, vein condition, and medical history, while external factors encompass chemical and mechanical causes (Setiawan et al., 2022). A study conducted at Mega Buana University Palopo identified significant predictors of phlebitis in children, including age, gender, health condition, and the duration of catheter insertion (Arung & Fadli, 2023). Additional studies have emphasized that children's anatomical and behavioral characteristics, such as smaller vein diameters, limited communication skills, immature immune systems, and unpredictable movements, can complicate the insertion and maintenance of peripheral intravenous catheters (Bunga & Widhiati, 2018). The consequences of phlebitis include pain, discomfort, increased frequency of catheter replacement, and higher treatment costs. If left untreated, phlebitis can lead to complications such as cellulitis, sepsis, or deep vein thrombophlebitis (Setiawan et al., 2022).

The management of phlebitis includes both pharmacological and non-pharmacological approaches. One commonly used non-pharmacological method is the application of compresses. Studies have shown that nurses frequently use warm and cold compresses to relieve phlebitis symptoms (Supriadi, 2021). Warm compresses, in particular, have been found effective in reducing pain in hospitalized children with phlebitis. Patients receiving warm compresses showed significant pain reduction by the second and third days post-intervention, compared to a control group that did not receive

any intervention (Supriadi, 2021). Cold compresses are also used to reduce inflammation by inhibiting prostaglandin production, thus controlling the inflammatory response (Hajiabadi et al., 2023). Applying cold compresses for 5 minutes, twice daily over three days, has proven effective in alleviating pain, bruising, and hematoma in phlebitis patients (Supriadi, 2021).

Additionally, the use of 0.9% NaCl compresses has been reported as effective in decreasing phlebitis severity. The mechanism involves reducing edema and erythema through osmosis (Risnawati et al., 2021). Another approach that combines warm and cold compresses is known as Contrast Water Therapy (CWT), a form of hydrotherapy alternating between warm (41–43°C) and cold (10–18°C) water. This therapy is typically used during the subacute phase of inflammation to improve circulation without exacerbating swelling (Supriadi, 2021).

Studies have shown that contrast hydrotherapy is more effective than cold application alone in relieving pain, enhancing functional ability, and improving the quality of life for patients with knee osteoarthritis (Ibrahim Abd elFatah, 2019). Similarly, contrast baths have been shown to reduce lower extremity edema in patients with congestive heart failure (Anggraini & Amelia, 2021). In the context of intravenous catheter complications, contrast hydrotherapy has been demonstrated to significantly reduce the risk of thrombophlebitis (Patali et al., 2023). Other studies have confirmed that combining hot and cold compresses as part of Contrast Hydrotherapy is effective in decreasing the degree of phlebitis in patients with intravenous catheters (Supriadi, 2021).

Preliminary observations in one of the pediatric wards of a regional public hospital in West Jakarta identified 10 pediatric patients with phlebitis, predominantly with grade 2 or 3 severity. Of these, three patients were aged 1–5 years, five were aged 5–10 years, and two were aged 10–15 years. These children were mainly receiving electrolyte and antibiotic therapy. However, there was no specific therapeutic intervention for phlebitis in the ward other than the application of 0.9% NaCl compresses. Given this gap in care, contrast hydrotherapy—an approach involving alternating hot and cold compresses to stimulate circulation and reduce inflammation—presents a promising alternative.

Despite its potential, the application of contrast hydrotherapy in pediatric phlebitis cases has not been extensively studied. Therefore, this study aims to evaluate the effectiveness of contrast hydrotherapy in reducing the severity of phlebitis in children. The findings are expected to contribute significantly to the knowledge base and clinical practices related to phlebitis management in pediatric patients undergoing maintenance intravenous therapy. This study aims to determine the effect of contrast hydrotherapy on the degree of phlebitis in pediatric patients.

2. Materials and Methods

The research employed a pre-experimental design, specifically the One Group Pretest-Posttest Design, which involves a single group observed before and after the administration of an intervention.¹⁴ This design includes two measurement points: one before (pretest) and one after (posttest) the experimental treatment, allowing for the assessment of changes following the intervention. The population in this study consisted of all pediatric patients who were treated in the pediatric ward of a regional public hospital in West Jakarta and experienced phlebitis due to intravenous infusion during January 2025. Based on Roscoe's guideline as cited in Sekaran's book, a simple experimental study typically involves a sample size of 10–20 participants. Accordingly, this study included 20 pediatric patients as respondents, selected based on specific inclusion criteria, particularly those with phlebitis graded at level 2 or 3 using the Visual Infusion Phlebitis (VIP) score. The decision to focus on VIP scores of 2 and 3 was grounded in clinical considerations: these scores represent early and moderate stages of phlebitis. Higher scores, such as levels 4 and 5, indicate advanced phlebitis or early thrombophlebitis, which require more intensive monitoring and treatment. Therefore, patients with VIP scores of 4 or 5 were excluded from this study.

The sampling technique used in this study was purposive sampling, where participants were selected based on the predetermined inclusion criteria. The selected respondents received the contrast hydrotherapy intervention in accordance with a standardized operating procedure (SOP). The intervention was evaluated using several tools: the Visual Infusion Phlebitis (VIP) score, an observation sheet, and the CDC growth chart (Centers for Disease Control and Prevention). For the univariate analysis, descriptive statistics were used to examine each research variable, producing outputs such as the mean, median, standard deviation, minimum, and maximum values. The normality of the data was assessed using the Shapiro-Wilk test, which yielded a significance value of $p < 0.05$, indicating that the data were not normally distributed. Given the non-normal distribution of the data, the study employed a non-parametric statistical test, specifically the Wilcoxon signed-rank test, to conduct the bivariate analysis. This test was chosen to compare the mean values of two paired groups (pretest and posttest) and determine whether there was a statistically significant change in the phlebitis scores following the intervention.

The research process began with administrative and ethical preparations. A formal request for research permission was submitted to the academic division of Universitas Indonesia Maju. Ethical approval for the study was obtained from the Health Research Ethics Committee of Universitas Indonesia Maju, with approval number 9849/SKET/Ka-Dept/RE/UIMA/XII/2024.

3. Results and Discussion

Result

Table 1. Respondent Characteristics Overview (n=20)

Characteristics	Category	Frequency	
		n	(%)
Age	6-10 Years	11	55.0
	10-19 Years	9	45.0
Type Sex	Man	8	40.0
	Woman	12	60.0
Nutritional Status	Malnutrition	4	20.0
	Normal	16	80.0
Type Fluid Intravenous	Non electrolyte	0	0
	Electrolyte	20	100
History Disease	Acute	10	50.0
	Chronic	10	50.0
Therapy Antibiotics	Yes	17	85.0
	No	3	15.0

Based on Table 1, most respondents were children aged 6–10 years (55%). The majority were female (60%), and most had a normal nutritional status (80%). All patients received electrolyte intravenous fluids (100%). Regarding medical history, 50% of the respondents had acute illnesses, and 50% had chronic illnesses. A large proportion (85%) received antibiotic therapy.

Table 2. Description Degrees Phlebitis on Child Before and After Contrast Hydro Therapy (n=20)

Degree of Phlebitis		n	Mean	Std. Deviation	Min	Max
Intervention Contrast Hydro Therapy	Before	20	2.55	0.51	2	3
	After	20	0.2	0.41	0	1

Table 2 shows the average degree of phlebitis in pediatric patients before and after contrast hydrotherapy. Before the intervention, the mean severity score was 2.55, indicating moderate to severe phlebitis. Following the intervention, the mean score decreased significantly to 0.20, indicating minimal or no signs of phlebitis.

Table 3. Influences Giving Contrast Hydro Therapy To Degrees Phlebitis on Child (n=20)

Providing Contrast Hydro Therapy		n	Z	p
Degree of Phlebitis	Before	20	-4,072	<0,000
	After	20		

As presented in Table 3, the Wilcoxon Signed Rank Test yielded a Z-value of -4.072 with a significance level (p-value) of < 0.000. Since the p-value is less than 0.05, it can be

concluded that there is a statistically significant difference in the degree of phlebitis before and after contrast hydrotherapy. These results confirm the effectiveness of contrast hydrotherapy in reducing phlebitis severity among pediatric patients.

Discussion

Based on the analysis of respondent characteristics by age, the majority of pediatric patients with phlebitis were in the 6–10-year age range, comprising 11 respondents (55%). This finding aligns with previous research at Nurdin Hamzah Hospital, which reported that children aged 10 years dominated phlebitis cases, accounting for 4.5% of the sample (Harianti, 2023). Theoretically, phlebitis has both internal and external causative factors. Internal factors include age, sex, nutritional status, vein condition, and underlying illnesses. The researchers suggest that children aged 6–10 years are more prone to phlebitis due to the smaller, more fragile nature of their veins and increased susceptibility to intraluminal pressure during intravenous therapy.

In terms of gender, the majority of respondents were female, accounting for 12 individuals (60%). This finding is consistent with a 2023 study, which found that 51.1% of pediatric patients with phlebitis were female (Arung & Fadli, 2023). Other studies have also noted that phlebitis tends to be more prevalent in females compared to males. Physiologically, this may be attributed to differences in vascular structure, function, and disease risk between sexes, influenced by anatomical and hormonal factors. Researchers assume that narrower blood vessels in females may contribute to a higher risk of phlebitis. Analysis of the respondents' nutritional status showed that 80% (16 respondents) had a normal nutritional status. Previous studies have identified nutritional status as one of the internal factors influencing the incidence of phlebitis (Rosita et al., 2023). Another study reported that 43.3% of phlebitis patients had normal nutritional status, out of a total of 30 respondents (Hartanto & Alimansur, 2017). Nutritional status reflects the balance between nutrient intake and utilization, and imbalances may lead to disorders, especially in children. It is assumed that good nutritional status supports the wound healing process in phlebitis patients by enhancing immune function and tissue repair mechanisms.

All respondents in this study (100%) received intravenous electrolyte fluids. This corresponds with findings from other studies, which showed that 84.4% of phlebitis cases were associated with the use of isotonic fluids (Kurniawan et al., 2017). Although hypertonic fluids theoretically carry a higher risk of causing phlebitis, the higher incidence found in patients using isotonic fluids may be explained by their predominant use in clinical settings (Rosita et al., 2023). Researchers infer that fluids with higher osmolarity increase the risk of endothelial irritation and inflammation, thereby increasing the incidence of phlebitis.

Half of the pediatric patients (10 respondents or 50%) had a history of acute or chronic illness. A 2020 study reported that 43.2% of patients with phlebitis had underlying diseases such as diabetes mellitus, hypertension, asthma, high cholesterol, angina, or breast cancer (Defi & Fibriana, 2020). Chronic illnesses compromise immunity and peripheral blood circulation, thus increasing the risk of inflammation. For example, diabetes mellitus leads to vascular atherosclerosis, and hypertension accelerates organ deterioration. Therefore, the presence of chronic disease is a significant predisposing factor for phlebitis.

Most respondents (85%, or 17 children) received antibiotic therapy. This is in line with a 2019 study where 74.2% of 97 respondents with phlebitis received antibiotics (Sutanto & Iqbalwanty, 2020). Phlebitis is often classified as a nosocomial infection resulting from intravenous catheter insertion. Antibiotics, which may be natural or synthetic, are intended to prevent or treat these infections. However, the study acknowledges that in some healthcare settings, the effectiveness of antibiotics in preventing phlebitis remains questionable.

Prior to the intervention, the average phlebitis degree among patients was 2.55. After three days of contrast hydrotherapy, this decreased to 0.2. These results are consistent with prior studies showing that patients undergoing Contrast Water Therapy (CWT) initially exhibited grade 2 (59.1%) or grade 3 (40.9%) phlebitis, with marked improvement after therapy (Supriadi, 2021). Cold compresses, by comparison, were less effective. CWT successfully reduced phlebitis severity to grade 1, indicating early-stage inflammation. Intravenous therapy over extended periods is a major contributor to phlebitis due to chemical, mechanical, and bacterial factors. Symptoms include erythema, pain, swelling, and the development of hardened venous areas (Hasanah et al., 2017; Lestari et al., 2025). Pediatric patients are especially vulnerable due to longer catheterization periods, increased physical activity, and less secure catheter fixation.

According to the researchers, the high incidence of grade 2 and 3 phlebitis is associated with long-term intravenous therapy. Administering contrast hydrotherapy twice daily for three days significantly reduced phlebitis severity. The therapy's alternating application of warm and cold compresses appears effective in improving circulation and reducing inflammation. One patient who remained at grade 1 post-therapy was noted to be malnourished—highlighting the role of nutrition in wound healing and phlebitis resolution.

The Wilcoxon Signed Rank test yielded a significance value of 0.000, below the alpha threshold of 0.05. This result confirms a statistically significant difference in phlebitis severity before and after the intervention. A related study similarly showed significant improvement in patients receiving CWT, without adverse effects (Supriadi, 2021). Additional research has supported the effectiveness of contrast hydrotherapy in

improving clinical outcomes. In patients with knee osteoarthritis, this therapy reduced pain and enhanced quality of life (Ibrahim Abd elFatah, 2019). It also helped decrease edema in patients with congestive heart failure (Anggraini & Amelia, 2021) and was effective in reducing the risk of thrombophlebitis in intravenous catheter patients (Patali et al., 2023).

The principle behind this method is the application of alternating temperatures, typically 41–43°C for warm water and 10–18°C for cold water, promoting vasodilation and vasoconstriction cycles. Though immersion is the standard method, this study employed compressed. Heat promotes oxygenation and nutrient delivery, while cold helps reduce inflammation and swelling (Supriadi, 2021). This dual action supports tissue healing and enhances patient comfort. The researchers conclude that contrast hydrotherapy effectively reduces phlebitis severity due to its physiological benefits, particularly when applied consistently over three days.

4. Conclusion

The research findings indicate that contrast hydrotherapy is an effective intervention for reducing the severity of phlebitis in pediatric patients. This therapy has the potential to serve as a safe, non-pharmacological alternative that is simple to apply in clinical nursing practice, particularly in the management of infusion-related complications. Its effectiveness reinforces the importance of a holistic approach in the care of children experiencing phlebitis. Nurses and other healthcare professionals are encouraged to integrate contrast hydrotherapy as part of nursing interventions aimed at managing phlebitis, especially within pediatric populations. Healthcare institutions are also advised to develop standard operating procedures (SOPs) for the implementation of this therapy to ensure both its safety and effectiveness. Further research is recommended to explore the optimal duration, frequency, and effects of contrast hydrotherapy across different age groups and clinical conditions to enhance the generalizability of these findings.

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